

## PATENT SPECIFICATION



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## COMPLETE SPECIFICATION

## Improvements in or relating to Power-driven Hand-guided Machines

We, ROBERT BOSCH AKTIENGESELLSCHAFT, a German Company, of 4, Militärstrasse, Stuttgart, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to power-driven hand-guided machines.

In the friction clutches usually adapted in power-driven hand-guided machines the clutch linings bear upon each other during operation under the steady unvarying pressure of helical springs. The maximum torque transmissible by such a clutch depends, however, not only on the degree of this pressure, but also on the value of the frictional resistance which diminishes as the relative speed of the parts of the clutch, which slide on each other rises, and is greatest by far during relative rest between them. In such machines, at the moment when the clutch is disengaged (when, for instance a driven drill, in penetrating through a wall to be drilled, suddenly encounters increased drilling resistance and stops), the clutch faces must be brought from the condition of relative rest into the condition in which they slide on each other, which as above stated requires a specially high peak torque. This peak torque manifests itself in portable hand-tool machines by the machine exerting a reaction or kick corresponding to the peak of the torque on the hand of the operator holding it. Owing to this kick the machine very often slips from the hand of the operator, or throws him to the ground, if he is gripping it firmly and is not prepared for the shock. In high and unprotected working places, for instance on lofty steel frame buildings, this circumstance has even resulted in fatal falls. Consequently operators are nervous and fail to apply pressure correctly on their machines which considerably adversely effects the result of the work.

The present invention removes this serious defect of known power-driven hand guided machines, in that a clutch comprising a set of plates or lamellæ

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normally held in contact between end members operating under a resilient load is built in between the motor and the gearing, whilst a nut is provided between the clutch and the driven shaft of the machine which nut bears against both members at its ends and has a rigid connection with the clutch in the direction of rotation but is adjustable on the shaft by a thread of quick pitch, whereby on the torque exceeding a predetermined amount the nut is moved to displace one of the members against the loading pressure and thus separates the plates of the clutch. By the control device mentioned the clutch is positively relieved when a definite harmless maximum torque is exceeded independently of the fluctuating value of the friction co-efficient, so that independently of the momentary relative speed of the clutch parts at the moment of the increased torque, the halves of the clutch slip relative to each other when the predetermined torque occurs. The peak torques above mentioned cannot occur on the movement of the clutch halves which have been quietly bearing on each other. The known control devices of this kind have hitherto only been provided for use with apparatus in which the described serious consequences existing in power-driven hand-guided machines cannot occur. It is precisely due to the fact that in power-driven hand-guided machines the operator has to apply the counter-torque for the machine, that the employment of the control device mentioned in hand-tool machines results in the unexpected improvement, that for the first time the operator can firmly hold the machine in the hand, even high power machines, with a freedom from care, and need fear no recoil or kick. Furthermore, in the known control devices of the kind referred to an important circumstance has been overlooked, namely that in those clutches having a control device this is provided between the motor and clutch, and further, the outer plates are connected to the gear side of the shaft. This has however the considerable drawback, which in certain circumstances even annuls the action of the control device,

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that the casing with its large dimensions necessary for supporting the outer plates must be braked on the sudden occurrence of a resistance to rotation. In this way, in spite of the control device provided in the known arrangements, quite considerably recoil shocks can still occur.

Applied to the case of the power-driven hand-guided machine, that would mean that the operator even now has still to reckon on recoils, and further that the saving of the gearing also intended in the invention with the arrangement of the control device is not attained. The position of the control device provided according to the invention, and its connection with the plates or lamellæ, is of great importance in power-driven hand-guided machines, especially in view of the very high speeds here employed (up to 15.000 revolutions per minute).

The invention can also be applied to machines which are adapted both for left and right hand rotation.

An example of construction of the invention is diagrammatically shown in the accompanying sectional drawing.

Portions only of the machine casing are indicated at 1 and 2, namely at the places where the motor shaft is mounted in the casing. At 1 a hollow rotor shaft 3 is mounted in a ball-bearing 8. It carries, mounted fast on it, the short-circuited rotor 4 of a three-phase induction motor. In this hollow shaft 3 a solid driven shaft 18 is mounted at one end in a sliding bearing 6 and at the other end in a ball-bearing 5. The driven shaft itself is mounted at 2 in the casing of the machine in a ball-bearing 7.

The clutch-casing is fixed to the hollow shaft 3. It consists of the hollow cone-shaped part 9 which is closed by a cover-like part 10. The part 9 has also wing extensions 23, so that it acts at the same time as a fan.

The plates 11 of the clutch are coupled at their outer edge to the part 9 in the direction of rotation whilst the plates 12 engage with their inner edges in a nut 13, in which they are longitudinally displaceable. The set of lamellæ or plates consists of the plates 11 and plates 12 arranged in alternate layers. These plates are compressed by end pressure plates 14 and 15 and springs 16 and 17 which bear against the parts 9, 10, of the clutch-casing. The nut 13 engages with a multiple thread 19 of quick pitch, which is provided on the driven shaft 18.

The mode of working of the clutch is as follows:—

In the absence of a great resistance to rotation that is for example, in normal drilling, the torque of the rotor 4 is trans-

mitted to the shaft 18 through the hollow shaft 3, the clutch-casing 9, the plates 11, the plates 12 and the nut 13. From the shaft 18 it is further transmitted through the toothed wheels 20 indicated to the tool-spindle proper. The pitch of the thread 19 is such, that this transmission can only take place up to a certain maximum torque. On this torque being exceeded, for example owing to the stoppage of the drill, the nut 13, which up to then has remained stationary relative to the shaft 18, begins to move in one direction or the other according to whether the rotor revolving to left or right. By this movement the nut raises either the plate 14 or 15 from the set of plates 11, 12, against the the force of the springs 16 or 17 respectively, and so prevents any further transmission of torque. In order that the pressure plate 14 or 15 which is not lifted may be prevented from following the lifted plate, screws 21 are screwed into the clutch-casing 9, and have an extension 22 each of which lies between the pressure plates 14, 15. The width of each extension 22 is such that said extensions serve as a stop for preventing movement of each plate 14, 15 in the direction of the other.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A power-driven hand-guided machine in which a clutch comprising a set of plates of lamellæ normally held in contact between end members operating under a resilient load is built in between the motor and the gearing, whilst a nut is provided between the clutch and the driven shaft of the machine which nut bears against both members at its ends and has a rigid connection with the clutch in the direction of rotation but is adjustable on the shaft by a thread of quick pitch, whereby on the torque exceeding a predetermined amount, the nut is moved to displace one of the members against the loading pressure and thus separates the plates of the clutch.

2. A machine as claimed in Claim 1, in which the set of plates or lamellæ is compressed from both ends by spring-loaded pressure plates, the movement of either of which in the direction of the other is limited by a stop.

3. A machine as claimed in claim 2, in which the stop consists of screws which are insertable from the outside radially into the clutch-casing and extend into the path of movement of the pressure-plates.

4. A machine as claimed in Claim 2 or 3 in which the shanks of the screws are of

such width, that they limit the path of displacement of each pressure plate in a direction towards the other.

5. A machine as claimed in any of the preceding claims in which the clutch elements are mounted concentrically about the axis of the motor.

6. A machine as claimed in Claim 5, in which the shaft driven by the clutch is mounted in a hollow shaft of a motor.

7. A machine as claimed in any of the preceding claims, in which the clutch-

casing is made in one piece with a fan of the machine.

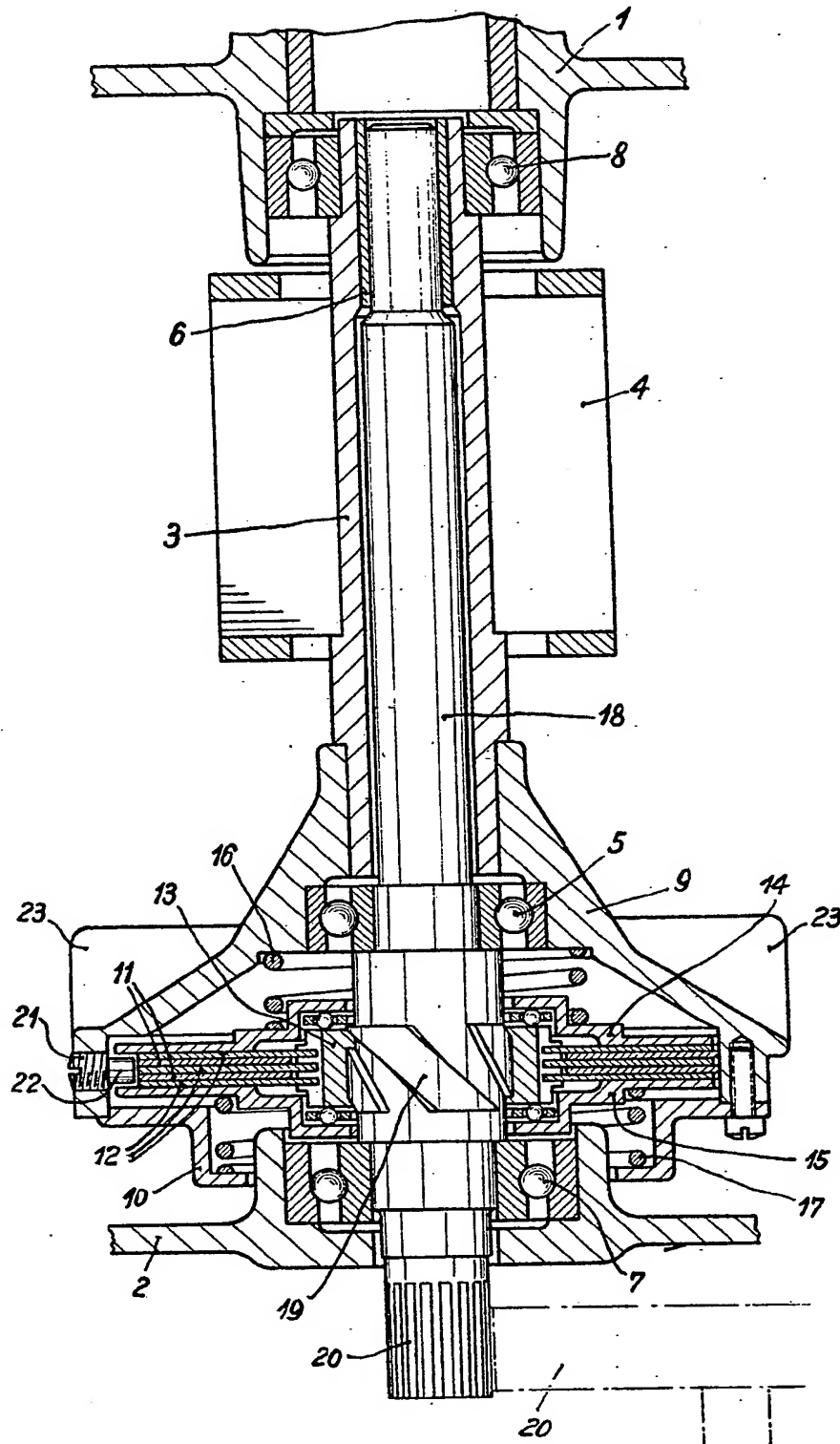
8. A power-driven hand-guided machine constructed and arranged to operate as particularly described with reference to and as shown in the accompanying drawing.

Dated this 20th day of November, 1936.

W. P. THOMPSON & CO.,  
12, Church Street, Liverpool,  
Chartered Patent Agents.

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*[This Drawing is a reproduction of the Original on a reduced scale.]*



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